



Published in final edited form as:

Soc Dev. 2010 August 1; 19(3): 601–626. doi:10.1111/j.1467-9507.2009.00549.x.

Symbols Build Communication and Thought: The Role of Gestures and Words in the Development of Engagement Skills and Social-Emotional Concepts during Toddlerhood

Claire D. Vallotton^{1,2} and Catherine C. Ayoub²

¹Michigan State University

²Harvard University and Medical School

Abstract

Social skills and symbol skills are positively associated in middle childhood, but the relation between these domains is less clear in newly verbal toddlers. Vygotsky (1934/1986) proposed that symbols are both tools for interaction and mental tools for thought. Do symbols help even very young children build skills for interacting with and conceptualizing the social world? Longitudinal data from 108 children and mothers were collected when children were 14, 24, and 36 months. Children's gestures and words during mother-child interactions were used as symbol skill indicators to predict children's abilities to engage others and the number of social-emotional concepts children portray during play. In a series of growth models, words had a stronger effect on engagement skills while early gesture use predicted later development of social-emotional concepts. Therefore, even in early development, symbols serve as both communication tools and mental tools to construct understanding of the social-emotional world.

Keywords

social development; language; gesture; early childhood; symbol

Even before children can consistently use language, symbols, in the form of words or gestures, facilitate social interactions of many kinds. By the time they are three years old, most children are adept at using words to engage and communicate with others, as well as to represent increasingly complex social concepts. But the beginnings of this connection between developmental domains can be seen in everyday interactions in infancy and toddlerhood, as illustrated by the anecdotes below.

During a typical morning in an infant classroom, 13-month-old Ji-Yun turned to her caregiver and pointed out the window. The caregiver responded “You're pointing out the window. Do you see that bird in the tree?” Ji-Yun flapped both arms up and down, the gesture she learned to symbolize bird. “That's right,” the caregiver said, “you see the bird.” Ji-Yun smiled. She had successfully engaged her caregiver in a social interaction using simple gestures.¹

In the toddler classroom next door, 23-month-old Daniel got his caregivers' attention, then pointed to a stuffed bear which lay on a wooden block. He put his

Send correspondence to: Claire Vallotton, PhD 2G Human Ecology Michigan State University East Lansing, MI 48823
Vallotto@msu.edu.

¹These anecdotes were observed by author Claire Vallotton at the UC Davis Center for Child and Family Studies, a laboratory school where symbolic gestures are modeled by caregivers. Names have been changed, but ages are accurate.

finger in front of his mouth and said quietly, “Baby...” His caregiver replied, “Shh...is baby sleeping, Daniel?” Daniel nodded and put his finger in front of his mouth and said, “Shh.”

Ji-Yun demonstrates the use of gestures to begin and sustain an interaction, while Daniel's behavior illustrates how gestures and words can be used to represent a social concept, revealing a basic understanding of care or nurturance demonstrated by his pretense of telling others to be quiet so as not to wake a baby. Could these early symbol skills also be mental tools, as suggested by Vygotsky (1934/1986), with which Ji-Yun and Daniel will *build* their understanding of the social-emotional world? That is, can words and gestures serve both a communicative and representational function in early development and do they actually help children build their social representations?

Though associations between social skills and symbol skills are reported widely in developmental research (e.g. Baldwin & Moses, 2001; Zeidner, Matthews, Roberts, & MacCann, 2003), little is known about the underlying relation between these domains in preverbal children. It is between 1 and 3 years of age that children show the most rapid growth in use of gestures and words, as well as in social awareness and interaction skills. Yet most studies relating language to social skills begin after three years of age, when children are using language in more complex ways. Variations in typical gesture and language development appear to be related to variations in social skills in older children; it is our aim to discover how these domains are related earlier in development, as children learn their first language. Therefore, we examine the relation of growth in these domains between 14 and 36 months of age, hypothesizing that symbol skills support the development of social skills.

Below, we begin by describing the dual roles of symbols as both communication and representation. Then, we describe what is currently known about the relation between symbol and social skills, literature that rarely includes very young children. Finally, we describe our hypotheses that early symbol skills support the development of social skills, including children's ability to engage others and their understanding of social-emotional concepts.

Symbol Skill Development in Young Children

Symbol skills are a set of abilities that enable humans to represent concepts in their absence. These abilities develop from concrete to abstract, and from primarily physical to both physical and mental (Werner & Kaplan, 1963). Symbols serve two distinct social-cognitive functions: communication and representation. Vygotsky (1934/1986) proposed that symbols are learned within a social context and, once internalized, can be used not only to share meaning with others, but also as mental tools to construct an understanding of the world. Studies by Vygotsky and colleagues showed that language supports cognitive problem-solving in preschool-aged children (see Harris, 1990 for review). We extend these ideas to the role of symbols in building social skills.

As their symbols become more abstract and abundant, children begin to represent concepts that are more complex and abstract, beyond the here and now. But the precursors of abstract representation are seen in concrete communicative behaviors such as gestures (Goldin-Meadow, 2005a; Werner & Kaplan, 1963). Therefore, we examine both words and gestures as two separate, but related, early indicators of symbol skills.

Language: vocabulary and talkativeness—Spoken language emerges early in the second year of life and increases rapidly, undergoing several growth spurts (Reich, 1986), documented in both cumulative vocabulary (Huttenlocher, Haight, Bryk, Seltzer, & Lyons,

1991) and the number of different words used spontaneously during interactions (Pan, Rowe, Singer, & Snow, 2005). Of the many component skills that comprise language ability, we examine vocabulary and talkativeness as indicators of representational breadth and communicativeness, respectively. Vocabulary is associated with the sophistication of toddlers' symbolic behaviors in play (Tamis-LeMonda & Bornstein, 1994), indicating underlying representational skills. Yet it may be children's talkativeness that directly engages others in interaction, serving the communicative function of language. We will test the relationship between these two components of language and the two social skill outcomes.

Pointing—Gestures are intentional motor acts that usually serve to communicate with another. Emerging around nine months, pointing is one of the earliest gestures (Carpenter, Nagell, & Tomasello, 1998; Crais, Douglas, & Campbell, 2004) and a primary means of intentional communication in infancy (Leung & Rheingold, 1981). Children are capable of using systems of symbolic gestures which represent objects or concepts in their absence (Acredolo & Goodwyn, 1988). But pointing is a simple gesture that can refer to any number of different objects, which makes pointing *non*-symbolic by some criteria (Werner & Kaplan, 1963). However, early pointing predicts children's later vocabulary (Blake, Vitale, & Osborne, 2005; Rowe, Ozcaliskan, & Goldin-Meadow, 2008) and the timing (McEachern & Haynes, 2004) and complexity of their first sentences (Iverson & Goldin-Meadow, 2005). Thus, pointing is an early indicator of later representational skills.

Goldin-Meadow (2007) argues that pointing facilitates the child's first experiences of shared intentionality and shared meaning, which Vygotsky (1934/1986) proposed is the intermental context in which children learn symbols. Further, pointing can be used by very young children to represent an absent referent (Lizkowski, Carpenter, & Tomasello, 2007), bringing into question the idea that pointing is not representational or symbolic, and serves only as a communicative function of language. Thus, we expect pointing to serve the communicative function of language and to promote communicative aspects of social skills, but we also examine whether pointing serves the representational function of language by testing whether it supports the development of social-emotional concepts.

Despite evidence of a positive relationship between infants' pointing and language development, Rodrigo, Gonzalez, and Ato (2006) found that during later toddlerhood pointing and other instrumental gestures are negatively related to language. That is, while pointing is a central tool for communication in infancy, those pointing more often during toddlerhood are usually not yet using more specific representational gestures and words. Therefore, we question whether pointing consistently predicts children's social development throughout toddlerhood, whether its relation to social skills becomes negative, or if the effect of pointing on social skills simply wanes as it is eclipsed by vocal words.

The Relation Between Symbol Skills and Social Development

Despite the fact that both symbol and social skills are undergoing rapid development in early childhood, the relation between these domains in young children is relatively unexplored. The development of language and social skills are clearly related in preschool and middle childhood, including the development of emotional intelligence (Zeidner, Matthews, Roberts, & MacCann, 2003), social understanding (Baldwin & Moses, 2001), and self control (Vaughn, Kopp, & Krakow, 1984), even when age and developmental timing are taken into account (Cassidy et al., 2003). Additionally, young children's use of and ability to follow others' pointing predicts their ability to engage others in joint attention (Carpenter, Nagell, & Tomasello, 1998), while less frequent gesturing predicts deficits in joint attention, as seen in children with autism spectrum disorders (Mitchell, Brian, & Zwaigenbaum,

2006). In sum, the connection between language and social skills is well-established for middle childhood. However, evidence linking these domains in early childhood is largely correlational, and longitudinal work has focused on atypically developing children.

We suggest that symbol skills--gestures and words--actually support social development in multiple ways. We propose that the two roles of symbols, communication and representation, can be seen in their association with two different social skills: children's abilities to engage others in interaction, and their understanding of social-emotional concepts seen in their ability to actively represent social content in their play. We posit that, as communicative tools, symbols facilitate engagement of others in interaction. Further, in their representational function, symbols are mental tools (Vygotsky, 1934/1986) with which to understand social experiences and construct concepts of the social world.

Symbol skills as communicative behavior help children engage others—Joint attention in infancy, engagement of others in preschool, and social competence in later childhood form a continuum of skills for interacting with others by controlling one's own actions and reactions (Mundy & Acra, 2006). By 12 months, most infants are adept at coordinating their social behaviors to engage, re-engage, and direct the attention of a partner in joint attention (Morales, Mundy, & Crowson, 2005); and individual differences in these skills persist over time (Striano & Rochat, 1999). These engagement skills and inter-individual variations therein, become more elaborate as attention spans grow and children control a broader array of behaviors used to engage others (i.e. showing, sharing).

Language and gestures are used to engage others in communicative interaction. As the earlier anecdotes illustrate, preverbal children use gestures to engage others in joint attention (i.e. Crais et al., 2004). Further, an early sign that a child will have difficulty in social interactions is lack of gesture use in infancy (Yirmiya, Gamliel, & Pilowsky, 2006), and preschoolers with language delays have difficulty coordinating play with their peers (Horowitz, Jansson, Ljungberg, & Hedenbro, 2005). Looking early in development at both symbol skills indicators, we ask how children's gestures and language each contribute to children's engagement skills during toddlerhood.

Symbol skills as mental tools facilitate development of social-emotional concepts—Along with interaction skills, young children develop conceptual understandings of the social world. These concepts of emotion and social actions develop from simple dichotomies such as *happy* versus *not happy* or *mean* versus *nice* (Ayoub et al., 2006), to include greater and greater differentiation and complexity of subtle social-emotional events (Cunningham & Odom, 1986). Very young children demonstrate their social-emotional concepts through reactions to social situations, and in spontaneous and elicited themes, or concepts, acted out in their play (Ayoub & Fischer, 2006; Ayoub, Raya, & Russell, 2000; Dunn & Hughes, 2001). The ability to pretend or “pose” a variety of thematic material increases through early childhood; by the time they are 4-to-5 years old, children have developed a sense of cause and consequence between emotions and social actions (Lagatutta & Wellman, 2001) and have organized their representations of social actions into complex themes (Nelson & Ayoub, in press).

In addition to displaying social concepts, we propose that symbols actually help children construct and organize concepts of the social world. Vygotsky (1934/1986) suggested that symbols become the tools with which individuals construct knowledge, making sense of their experiences. Though the relation between domains may be bi-directional, there is evidence supporting Vygotsky's notion that earlier symbol skills support later social skills, but this relation has only been tested in fully verbal children (Astington and Jenkins, 1999). We extend Vygotsky's ideas to younger children and look at early indicators of these

symbolic tools. We ask whether both words and gestures simply display concurrent social-emotional concepts during play, or if they facilitate the growth of young children's social-emotional concepts.

The Current Study

We investigate the relation of symbol skills to two distinct social skills, and ask: 1) Do symbolic behaviors--in their *communicative* function--support the development of children's skills in engaging others in interaction? 2) Do symbolic behaviors--in their *representational* function--support children's conceptual understanding of the social-emotional world? We examined toddlers' developmental trajectories in engagement skills and social-emotional concepts and the degree to which variation in children's initial levels and growth rates in these domains varied as a function of three indicators of symbol skills: pointing frequency, talkativeness, and vocabulary.

Hypotheses about Engagement

To investigate the communicative role of symbols, we examined the growth of children's skills in engaging others. We hypothesized that children's pointing frequency and talkativeness would predict the *level* of engagement skills at each time, showing that children's use of symbols supports their concurrent engagement of others. We had two sub-hypotheses regarding pointing: first, early pointing – as an indicator of social awareness – would predict the rate of change in engagement, and second, later pointing would be less predictive of engagement skills than earlier pointing as growth in children's spoken language becomes their primary means of engaging others. Further, we tested whether vocabulary is uniquely important to engaging others when accounting for a child's talkativeness.

Hypotheses about Social-Emotional Concepts

To investigate symbols as mental tools, we examined the growth of the number and elaboration of children's social-emotional concepts acted out in play. We predicted that vocabulary, an indicator of representational breadth, would be uniquely important in the development of social-emotional concepts, controlling for children's talkativeness. Further, we explored whether early pointing, as an indicator of symbol skills, also predicts the growth of later social-emotional concepts. Consistent with the idea that symbol skills facilitate the development of social skills over time, we hypothesized that early pointing and vocabulary would predict the *rate of change* in the number of unique social-emotional concepts and the elaboration of social-emotional concepts acted out in play, even when accounting for the effects of concurrent language and gesture displaying social-emotional concepts.

Accounting for Interaction Context

We examined children's social and symbol skills in the context of their interactions with their mothers. The parent-child relationship is central to children's developing social skills and, according to Vygotsky, it is in this context that children internalize the symbols they will use to construct knowledge of the world. However, it is possible that mothers' language and pointing may drive any observed variation in children's social or language skills. For example, mothers' language use and literacy skills predict variation in children's vocabulary (e.g. Pan et al., 2005). Therefore, we account for maternal language and pointing during interactions to examine the impact of children's own symbol skills on their social skills.

Current Contribution

This paper extends the research linking language and social skills in several ways. Rather than treating language as a control variable, we investigated the role of symbol skills in the

development of social skills. We examined the relation between these domains earlier in development than previously reported; this earlier look is facilitated by our inclusion of gestures, as well as speech. Also, our use of three waves of longitudinal data allowed us to investigate growth trajectories and ask whether early symbol skills predict children's rate of growth in social skills, as well as their level of skills at each time.

Methods

Sample

Our dataset included 108 mother-child dyads in the Vermont site of the national longitudinal study on the effectiveness of Early Head Start (U.S. Department of Health and Human Services Administration for Children and Families, 2002). Children were predominantly European-American (91%) and exposed primarily to English at home (99%). Families qualified for the Early Head Start (EHS) intervention primarily because of low family income; the average annual family income was \$11,237 USD ($sd = \$7,778$). Forty percent of mothers had a high school education or equivalent; 28% had less than a high school education, and 32% had more.

Procedures

Children and parents were enrolled in the study before the child's first birthday. Families eligible for EHS were recruited during a 27-month period through posted flyers, door-to-door visits, and social service providers. Families were randomized to the EHS intervention or control group as they entered the study, though the two groups are combined for the purposes of the current study. Data were collected in three waves when children were approximately 14, 24, and 36 months of age. One hundred forty six families were recruited at the Vermont site, and 108 agreed to be videotaped. There was some expectable attrition between the first and third waves of data collection; one hundred and eight mother-child dyads were videotaped when children were 14 months old, 94 dyads participated at 24 months, and 75 at 36 months. There were no significant differences between the remaining families at wave three and the full sample in terms of baseline socio-demographic characteristics (see Love, et. al., 2005; See U.S. Department of Health and Human Services Administration for Children and Families, 2002 for complete information on recruitment and randomization procedures, and attrition).

Children and their mothers were videotaped for 10 minutes during a semi-structured play task called the "Three Bag" task, similar to that used by Vandell (1979). At the beginning of the Three Bag task, mothers were given three bags each containing age-appropriate toys meant to facilitate interaction. The first bag contained a book, the other two bags contained sets of several toys each. Dyads progressed through the bags at their own pace. Videotapes were coded using several different coding schemes for language and social skills, described further below. Coders of language were distinct from coders of social skills; coders were naïve to the scores on other measures and the hypotheses of the current study. Pointing gestures were coded for a randomly selected sub-sample of 60 children which did not differ significantly from the total sample in demographic characteristics.

Variables

Each predictor, control, and outcome variable is described in more detail below; univariate statistics are displayed in Table 1.

Predictor variables—Our primary predictor variables are those measuring children's symbol skills: pointing frequency, talkativeness, and vocabulary. We also use child age to predict basic change over time.

Child age—Child age was measured as the difference between child's date of birth and date of data collection at each wave; there was some variance around the target ages at each time.

Child symbol skills—Dialogue between mothers and children was transcribed verbatim using the Codes for Human Analysis of Transcripts (CHAT) transcription system which is part of the Child Language Data Exchange System (CHILDES, MacWhinney, 2000), a standard language coding and analysis system for the study of children's language in the context of child-adult or child-peer interaction. Each instance of pointing was noted in the transcripts. Transcripts were created for every mother-child pair each time. Symbol skill variables were created by extracting information from the transcripts using standard commands in the Computerized Language ANalysis (CLAN) software which is part of CHILDES.

Child's pointing frequency (*POINT*) is the total number of point gestures during the 10-minute interaction. Talkativeness (*TALK*) is the total number of words the child produced in the transcript, and vocabulary (*VOCAB*) is the number of unique words the child said during the interaction, taking out any repetitions to calculate an expressive vocabulary. To answer our questions regarding the role of early pointing in predicting later social development, as well as concurrent pointing predicting current level of skills, we used both time-varying and early, time-invariant pointing (*EARLY_POINT*) at 14 months in our analyses.

Control variables—Mothers' language and pointing during the same mother-child observations were recorded as part of the transcription of children's language. We created three language variables for mothers, parallel to the child variables, to control the potential influences of maternal language on our outcomes and predictors: Maternal pointing (*MOM_POINT*), maternal talkativeness (*MOM_TALK*), and maternal vocabulary (*MOM_VOCAB*).

Outcome variables—Children's ability to engage others during play and the social-emotional concepts in their play, observed during mother-child interactions, are described below.

Engagement—Child's engagement (*ENGAGE*)--defined as the degree to which a child interacted with her mother positively, and initiated, maintained, and responded to social bids--was scored on a scale of 1 (very low) to 7 (very high) based on both the quantity and quality of observed behaviors. Indicators of children's engagement included approaching or physically orienting to mother, establishing and maintaining eye contact, positively responding to mothers' initiations, directing or sharing expressions with mother, and engaging the mother in play or sustaining play which the mother initiated. Scoring was done by a team of graduate students naïve to the hypotheses of this study and the children's scores on the other measures. Coders achieved 85% agreement prior to independent coding; agreement was reassessed on 15% of observations, and agreement was 91% (intraclass correlation .68) (see Ipsa et al., 2004 for further information on the scale and reliability).

Social Concepts—Each social-emotional concept displayed by children during their play was coded from the same 10 minute videotaped episode using an adaptation of the Themes and Emotions coding scheme developed by P. Raya (Ayoub et al., 2000). With or without language and gesture, children represent social-emotional concepts in their play, particularly during pretend play, that can be identified by observers (e.g., a child pretending one character is being chased by another shows the concept of danger/threat, whereas a character taking care of another – for example, brushing hair or feeding – shows the concept of nurturance). Each concept coded was mutually exclusive, and together the list of concepts was

exhaustive for this sample. No distinction was made when a social concept was first initiated by the child or by the mother, but the child had to actively further the social concept in his or her play in order to have it coded. Each concept displayed by the child was recorded each time it occurred during mother-child interaction, thus we know the number of unique concepts displayed during play (*N_CONCEPTS* variable).

A second variable measures children's elaboration of social-emotional concepts (*E_CONCEPTS*), calculated as the percentage of play in which the child was representing a social-emotional concept that was not simply a routineⁱⁱ. Important to the analysis of our hypotheses, the coding of concepts did not rely on a child's verbal or gestural expression of related social content; rather, the coding of concepts took into account the content and context of children's play behavior. Reliability of this measure was established using Cohen's Kappa (Bakeman & Gottman, 1987), and was high, on average, across the inter-rated tapes (Kappa = .88). (See Appendix A for complete list and description of concepts.)

Analysis and Results

We have two distinct sets of hypotheses for the two social skills outcomes; thus we have two sets of analyses, though the variables and parameters share common interpretations. For the sake of clarity, we describe each set of analyses separately. (For complete information on the models fitted, and the details of their interpretations, contact the first author.)

Prior to analysis, we centered age at 14 months (*AGE-14*). We also transformed all symbol skills predictors (*POINT*, *EARLY_POINT*, *TALK*, *VOCAB*) and controls (*MOM_POINT*, *MOM_TALK*, *MOM_VOCAB*), as well as the elaboration of concepts (*E_CONCEPTS*) variable using the square root transformation to normalize their distributions. However, we present the de-transformed values in their original units in the tables and figures.

Engagement

Engagement analysis plan—Using SAS PROC MIXED, full maximum likelihood method of estimation, we fit a series of multilevel growth models to address our hypotheses about the effects of symbol skills on engagement skills (see Singer & Willett, 2003, for use of SAS PROC MIXED in fitting individual growth models). To establish the underlying shape of development for engagement skills during toddlerhood, we fit an unconditional quadratic growth model using the full sample of 108 children with social skills measures.

To address our hypothesis that pointing and talkativeness would each predict the level of engagement at each time, we entered the time-varying predictors *POINT* and *TALK* in separate models using the 60 dyads with complete data. To test whether early pointing predicts future engagement, we entered both the early- and time-varying predictors (*EARLY_POINT*, *POINT*) in the model, interacting early pointing with child age (*AGE-14*) to determine whether early pointing predicts the rate of change in child engagement. Also, to test whether the impact of pointing on engagement wanes as children get older, we interacted time-varying pointing with child age. We tested whether vocabulary predicted engagement skills when accounting for talkativeness by including *VOCAB* in the model with *TALK*. We also interacted *TALK* and *VOCAB* with child age to test for the possibility that their effects on engagement change over time. Finally, to test whether pointing contributes to engagement when accounting for language, we included all three symbol skills predictors together in the same model.

ⁱⁱRoutines were the most common theme in children's play, and were the only coded theme that was not specifically social in nature. Thus while children's playing of a Routine theme may display an elaborate concept, this behavior does not address our question regarding the role of symbols in the development of *social* concepts.

We added maternal talkativeness, vocabulary, and pointing as control variables any time the parallel child behavior was in the model. After our initial analyses we realized that controlling for maternal language may be over-controlling for the effects of children's pointing, that is, maternal language may be one mechanism by which children's pointing affects engagement. Children's pointing draws language from mothers (Goldin-Meadow, Goodrich, & Saur, 2007), which may affect both children's subsequent language skills, and their engagement with mothers. Thus we created a post-hoc model testing the effects of children's pointing on engagement skills controlling for children's but not mothers' language.

Engagement findings—The results of our analyses on engagement are presented in Table 2ⁱⁱⁱ. Children's engagement skills increase steadily (linearly) through toddlerhood (Model A), displayed in Figure 1, Panel A.

How does pointing affect the development of engagement skills?—As predicted, time-varying pointing affected children's concurrent engagement skills, such that greater pointing increased the level of engagement at each time (Table 2, Model B). Panel B of Figure 1 shows the effect of time-varying pointing on children's engagement with mothers. By 36 months, children who pointed one standard deviation more than average were one-third of a standard deviation higher in engagement than their average peers.

Counter to our hypotheses, early pointing did not predict the rate of change in engagement, nor did the effect of pointing wane as children got older. It appears that pointing is a stable contributor to toddlers' skills in engaging their mothers, even controlling for mothers' pointing. However, when either children's talkativeness or vocabulary and the parallel maternal variable were added to the model, the effect of pointing was diminished and became no longer significant. We initially believed that this was because children's language takes over the role of pointing. However, when we tested a model in which pointing and children's vocabulary, but not mothers' pointing or vocabulary, were included, the results (Table 2, Model E) showed that pointing does remain a significant predictor of children's engagement if mothers' behaviors are not controlled. That is, children's language does not take over the role of pointing, but mothers' language mediates the effect of child pointing on engagement skills.

How do children's talkativeness and vocabulary affect the development of engagement skills?—Consistent with our hypothesis, children's talkativeness at each time predicted their concurrent levels of engagement (Table 2, Model C), and the effect of talkativeness was stable over time. However, when both talkativeness and vocabulary were in the model, it was vocabulary, rather than talkativeness, that affected children's engagement (Table 2, Model D). Further, the effect of vocabulary increased as children got older (see the interaction between vocabulary and child age in Models D and E). Children who used a wider vocabulary, regardless of how talkative they were, engaged their mothers more throughout toddlerhood (Figure 1, Panel C). As both the variance in vocabulary and the strength of its impact grow, the cumulative impact of vocabulary results in a widening disparity in engagement, such that by 36 months children who were one standard deviation above average in vocabulary were one half of a standard deviation higher in engagement than children with average vocabularies.

ⁱⁱⁱThe values of the fitted parameters for pointing, talkativeness, and vocabulary may appear small, however, they are the values for the increase in engagement for each additional gesture or word the child performed during the 10-minute interaction.

Social-Emotional Concepts

Concept analysis plan—As with engagement, we used SAS PROC MIXED and started with unconditional growth models for the number of unique concepts ($N_CONCEPTS$) and elaboration of concepts ($E_CONCEPTS$) to describe their underlying shapes of development. We tested the effects of pointing and vocabulary independently, then included *TALK* in the vocabulary model to see the unique contribution of vocabulary controlling talkativeness. To test our hypothesis that early symbol skills help children *build* social concepts, we used the *EARLY_POINT* predictor, including its main effects and interaction with age to determine whether it predicts the *rate of change* in children's concepts over time. To apply the most stringent test, we included the time-varying predictor *POINT* in the models to see whether early pointing predicts development of concepts controlling the concurrent contribution of pointing. Finally, we included both early and time-varying pointing and vocabulary in the same model to see if early pointing still contributes to the development of social-emotional concepts accounting for children's growing vocabulary. Mothers' pointing, vocabulary, and talkativeness were included as controls when the parallel child predictors were included.

Concept findings—Below, we focus on the results for the number of different concepts in children's play (Table 3), and present the results for elaboration of concepts (Table 4) as they complement or contradict the results for number of concepts.

The average number of social-emotional concepts children displayed during play increased modestly between one and two years of age, then decreased slightly to three years of age (see the linear and quadratic rates of change in Table 3, Model A, and the trajectory in Figure 2, Panel A). Looking at the elaboration of themes (Figure 2, Panel B), it appears that the decline in number of concepts is due to the fact that children spent more time elaborating each concept, and playing out each theme longer as they get older.

How does pointing affect the development of social-emotional concepts in children's play?—Both early and time-varying pointing predicted the number of social-emotional concepts children displayed during play (Table 3, Model B). Even controlling for children's vocabulary and mother's pointing and vocabulary, early pointing still had a significant positive effect on the growth rate of the number of social concepts (Table 3, Model D). Further, early pointing also affected the growth rate of elaboration of concepts, even controlling children's and mothers' vocabulary and talkativeness (see Table 4, Model C). Panels A and B of Figure 3 show the effects of early pointing on the development of the number and elaboration of concepts. Panel A contrasts the trajectories of the numbers of concepts for three prototypical children who use average levels of time-varying pointing and vocabulary, but are at average and one standard deviation above and below average, in *early* pointing (0, 2.6, and 6.2 gestures respectively). As seen in Panel A, early pointing affects the shape of growth in concepts, that is, it affects the linear and quadratic rates of change in the number of concepts children display during their play. Children who point a lot as infants increased their number of concepts rapidly compared to their peers who did not point at all and showed almost no change in concepts.

Panel B^{iv} shows three prototypical trajectories of elaboration of concepts for children who used average early pointing, and were one standard deviation above and below average. Children who showed average pointing as infants had a modest increase in their elaboration of social-emotional concepts through toddlerhood. Those pointing more in infancy showed a

^{iv}Figure 3, Panel B shows the effect of early gestures on the rate of change in Concepts when time-varying gestures are controlled. However, until 24 months the time-varying and early gestures variables measure the same behavior, thus making the effect of early gestures appear negative in the early part of the trajectory.

rapid and steady increase in elaboration of social concepts; by the time they were 36 months, 8% of their play time was spent in playing at themes with social content, nearly a whole standard deviation above the average for that age. Those who were not observed to point at all in the infant measurement showed a slow decline in elaboration of social-emotional concepts.

How does language affect the development of social-emotional concepts?—

Time-varying vocabulary predicted the number of unique social-emotional concepts in play controlling for children's talkativeness and mothers' vocabulary and talkativeness (Table 3, Model C). Further, there was a significant interaction between vocabulary and age; that is, the effect of vocabulary on concepts increased over time. Figure 4, Panel A reveals that although vocabulary has little impact on concepts initially, its impact grows and by 36 months there is a difference of 0.42 standard deviations in the number of concepts between children who are one standard deviation above and below average in vocabulary.

Turning to the elaboration of social-emotional concepts, it is children's talkativeness, rather than vocabulary, that has a greater impact (Table 4, Model C). Figure 4, Panel B shows the impact of talkativeness on the percent of children's play that included a social-emotional concept, controlling for child pointing and vocabulary, and mothers' pointing, talkativeness, and vocabulary. Greater talkativeness is associated with a rapid increase in the elaboration of social-emotional concepts between 14 and 24 months of age, followed by a slight decline. Whereas children with average talkativeness display social-emotional themes in a maximum of 6% of their play, more talkative children (by one standard deviation) include social-emotional concepts in over 15% of their play.

Discussion

We set out to discover what roles symbol skills – including both gestures and words – play in the development of social skills during toddlerhood. We asked whether symbol skills are communicative tools contributing to a child's ability to engage another in interaction. Further, we asked whether they are mental tools which help children build social-emotional concepts. Overall, our results are consistent with our hypothesis that symbol skills – both words and gestures – are tools for both communication in and representation of the social-emotional world, even at this very young age. Though the subtleties of their influences on each outcome varied, all three indicators – pointing gestures, talkativeness, and vocabulary – contributed to children's social skills. Most interestingly, early pointing predicted the rate of development in social-emotional concepts, providing evidence that pointing is a rudimentary symbol skill in early development and may serve as a tool for representation as well as communication in the social-emotional domain. That is, the gestures used by Ji-Yun and Daniel in our earlier anecdotes may do more than simply display their social skills; they may actually help these young children build their concepts of the social-emotional world.

Early Symbol Skills as Communicative Tools? Effect of Symbol Skills on Engagement

On average, children's skills in engaging their mothers increased from 14 to 36 months. As expected, both words and gestures predicted children's abilities to engage others in social interaction. Our results were consistent with our prediction that symbol skills, as communicative tools, would help children engage their parents concurrently, that is, that the time-varying predictors pointing and talkativeness would be more predictive than the early measures of these same skills. However, two findings surprised us. First, pointing remained a significant predictor of engagement across the three time periods, even when accounting for spoken language. We had expected the role of pointing to diminish over time, particularly when controlling for language. This finding may indicate that pointing remains a

unique part of the communication system children use to engage others, rather than being subsumed within vocal language.

The second surprise was that children's vocabulary was more strongly related to engagement than talkativeness. We expected talkativeness to be more important as a gauge for motivation or willingness to engage. However, it may be that vocabulary is an indicator of the range of meaningful dialogue a child can share with another. A greater vocabulary indicates an increased potential for shared meaning. Thus, the representational function of language also facilitates engagement.

These results elicit the question: Would an early language intervention increase children's ability to engage others? Our empirical growth plots for vocabulary revealed that individual children often transition up or down in their language skills rank, with corresponding changes in engagement. This provides preliminary evidence that change in the trajectory of symbol skills is accompanied by change in the engagement trajectory, but this should be confirmed experimentally with young children given a language intervention, as has been done with older children (Burnard, 1996). Further, the relation between symbol skills and engagement skills should be studied in other social relationships. While the mother-child relationship is an important one in which to develop and display social skills, mothers tend to understand children's intentions relatively well even when their language is not clear. Symbol skills may be even more critical for engaging less familiar others, such as peers or teachers.

Early Symbol Skills as Mental Tools? Effect of Symbol Skills on Social-Emotional Concepts

Our central question was whether early symbol skills – such as gestures and words, – actually help children develop a representational repertoire of social-emotional concepts, rather than just displaying their existing conceptual repertoire. That is, do they act as mental tools with which children build their understanding of the social world? We tested this question by examining the roles of early indicators of symbol skills to see if they acted as mental tools, predicting the rate of change in children's later social-emotional concepts, or whether they just displayed concepts concurrently. We applied the most conservative test of this question allowed by our data; we included both time-varying (current) and early symbol skills (at 14 months) in the same analysis. The results showed that early pointing frequency was positively associated with the development of later social-emotional concepts, including both the number of unique concepts and the elaboration of concepts in play, even above the simultaneous effects of later pointing, vocabulary, and talkativeness which increased the concurrent levels of concepts. Therefore, we suggest that early pointing actually predicts children's ability to *build* a repertoire of social-emotional concepts, acting as a mental tool to increase their rate of concept development and elaboration over time.

Our interpretation of these findings on pointing is consistent with two bodies of literature on pointing. Tomasello, Carpenter, and Liszkowski (2007) examined the role of pointing in infants' growing social awareness and posited that pointing reveals rudimentary awareness of and intention to manipulate others' mental states, which is consistent with our results showing that pointing is a means for children to engage others. But, we actually posit that pointing plays a role in *building* social concepts, a hypothesis consistent with the work of Goldin-Meadow (2005b). Examining the role of pointing in cognition and language development, Goldin-Meadow proposes that gesture can take on the function of representation, or thought, when used alongside spoken language. However, we found that early pointing, *prior to* fluent vocal expression, predicted development of social concepts. Thus, we speculate that gesture may support and reveal thought both alone and with vocal language. Whether we think of pointing as primarily communicative, or as indicating more

abstract social awareness and symbol skills, our results make it clear that in infancy pointing is a strong predictor of toddlers' social development.

Parent-Child Interaction as a Possible Mediator Between Children's Symbol and Social Skills

The results from our study showed that children's pointing and vocabulary predicted concepts even while controlling for mothers' pointing and language; however, there may be a dynamic transaction between child and mother behavior which helps to explain the power of pointing in predicting concept development. Young children's gestures draw language from parents (Goldin-Meadow, Goodrich, Sauer, & Iverson, 2007), and mothers' verbal responsiveness to children's pointing predicts language development (Goodrich et al., 2007). Thus, enriched adult language – elicited by child pointing – may be a mechanism by which pointing influences children's development of social concepts.

Further, children as young as 12 months old use pointing to share their attentional foci with adults (Liszkowski et al., 2004), which facilitates shared meaning, the beginning of both social cognition (Carpenter, et al., 1998; Trevarthan, 1979) and the understanding of shared symbol systems which leads to language development (Tomasello & Farrar, 1986). It may be that the children in our sample who used more pointing also engaged more in joint attention, which then led to the development of both more shared symbols and greater social cognition. Thus, though symbol skills predict children's social concepts even when accounting for mothers' language, they cannot be seen as independent of the context of parent-child interaction.

Future Directions

Bidirectional relation between symbol and social skills—The current findings do not rule out a potential bi-directional relationship between social skills and symbol skills. Vygotsky (1934/1986) believed the two domains are linked inextricably. Many studies have found that variations in social interactions between parents and children predict language development (i.e. Feldman & Greenbaum, 1998; Laasko, Poikkeus, & Eklund, 1999), and it is easy to see how children's social skills could support language development through the language they elicit from caregivers. It is likely that symbol and social skills support one another in multiple complex ways, intertwining and integrating as they develop in typical individuals. Further experimental, longitudinal studies are needed to understand the intricate relation between these domains from infancy through childhood.

Possible early intervention: symbol skills as social tools—The current findings point to possible interventions. Providing infants and toddlers with symbolic tools earlier may help them engage parents and build knowledge of social-emotional concepts. It is possible that language-and gesture-rich environments may promote both symbol and social skills. The availability of curricula on using symbolic gestures with infants is an opportunity to test the relation between domains of development experimentally.

Limitations

Though the current findings are informative, our methods were limited in ways that prevented further exploration of the relation between symbol and social skills. Using only three waves of data limited us to modeling only a quadratic growth trajectory; we would need at least one or two more data points to further elucidate the true underlying shape of the developmental trajectories. Further, it would be worthwhile to follow these skills into later time points, however, lack of vertically equitable measures, those that measure the same concept but grow meaningfully over time, keeps us from doing so. Even the most commonly

used measures of development (i.e. MacArthur CDI, PPVT) are not vertically equitable because they are standardized for each age.

We were forced to constrain some of the variance components in our analyses because we had insufficient data to estimate all of them. Though we allowed the intercepts and linear rates of change to vary across children, we constrained the quadratic rates of change and the effects of other Level 1 predictors to be the same across all children.

More importantly, we could not disambiguate parent's influence on our measures of children's social skills. Though children's skills were measured as distinct from adult behavior, and we accounted for the effects of maternal language, there may be important interplays between adult and child social and symbol behavior as discussed above. Further studies should aim to understand how the dynamic interplay between domains within the child interacts with the same domains in the child's social context.

Conclusions

This study provides evidence that symbol skills, including both gestures and words, predict the development of children's social skills. The finding that early pointing facilitated development of later social-emotional concepts reveals early symbol skills as mental tools that help children build their understanding of the social world. Future studies should probe this early intersection of domains further to disentangle the bidirectional influences of symbol and social skills within the child and the bidirectional influences of children and their social contexts.

Acknowledgments

The authors thank Catherine Snow, Barbara Pan, Meredith Rowe, Pamela Raya, John Willett, Kurt Fischer, Elizabeth Nelson, and members of the Early Head Start Consortium. Research was made possible in part by the National Institute of Child Health and Human Development, grant number 1 F32 HD050040-01, the Office of Head Start, and the Roche Relief Fund.

Appendix A: Social-Emotional Concepts Coded During Children's Play

Behavioral themes represented in child's actions during pretense in play:

Affection:	Actions that demonstrate warmth and caring, through physical or verbal expression.
Affiliation:	Actions that give a sense of or desire for inclusion or belonging.
Aggression:	Verbal or physical actions that are hostile and destructive, those that would hurt or cause harm to another.
Blame:	Self or other is identified as responsible for a perceived "bad" incident.
Control:	Demonstrates a position of power over others. Includes refusal to cooperate, help or comply.
Cooperation:	Turn-taking, helping to get something done, or complying.
Danger/Threat:	Threatening or scary experience.
Empathy/helping:	A worried or concerned look or act to relieve perceived distress or another.
Failure:	Demonstrates inability to take care of self, inability to assert desire, gives in to another's demand, inability to resolve, master, or confront source of conflict, dilemma, or threat.
Mastery:	Demonstrates one of the following: 1) ability care for self, 2) attempt to engage in challenging activity, or 3) achievement of a goal, 4) a special skill 5) resolving a problem.
None:	No themes are apparent in child's play.
Nurturance:	Demonstrates care for another or looks after the physical needs of another.

Personal/physical injury/health:	Behaves as though s/he is sick, disabled or has an injury.
Rejection:	Exclusion of self or other from an activity.
Reparation:	Demonstrates “making up” for an accidental or intentional incident.
Rivalry:	Show of competition or striving for the attention of another.
Routine:	Routine activity such as shopping, sleeping, and eating.
Sharing or giving:	Offering something to another.

References

- U.S. Department of Health and Human Services, Administration for Children and Families. Making a difference in the lives of infants and toddlers and their families: The impacts of Early Head Start. U.S. Department of Health and Human Services; Washington, DC: 2002.
- Acredolo L, Goodwyn S. Symbolic gesturing in normal infants. *Child Development*. 1988; 59:450–466. [PubMed: 2452052]
- Astington JW, Jenkins JM. A longitudinal study of the relation between language and Theory-of-Mind development. *Developmental Psychology*. 1999; 35:1311–1320. [PubMed: 10493656]
- Ayoub, C.; Fischer, KW. Developmental pathways and intersections among domains of development. In: McCartney, K.; Phillips, D., editors. *Blackwell Handbook on Early Childhood Development*. Blackwell; Oxford, UK: 2006. p. 62-82.
- Ayoub C, O'Conner E, Rappolt-Schlichtmann G, Fischer KW, Rogosch FA, Toth SL, Cicchetti D. Cognitive and emotional differences in young maltreated children: A translational application of dynamic skill theory. *Development and Psychopathology*. 2006; 18:679–706. [PubMed: 17152396]
- Ayoub, C.; Raya, P.; Russell, C. *Emotions in pretense scheme coding manual*. Harvard University; Cambridge, MA: 2000. *Human Development and Psychology, Laboratory Manual*.
- Bakeman, R.; Gottman, J. *Observing Interaction: An Introduction to Sequential Analysis*. Cambridge University Press; 1987.
- Baldwin D, Moses LJ. Links between social understanding and early word learning: challenges to current accounts. *Social Development*. 2001; 10:309–239.
- Blake J, Vitale G, Osborne P. A cross-cultural comparison of communicative gestures in human infants during the transition to language. *Gesture*. 2005; 5:201–217. Special issue: Gestural communication in nonhuman and human primates.
- Burnard S. Promoting useful language in children with emotional and behavioural difficulties. *Emotional and Behavioural Difficulties*. 1996; 1:17–23.
- Carpenter M, Nagell K, Tomasello M. Social cognition, joint attention, and communicative competence from 9 to 15 months of age. *Monographs of the Society for Research in Child Development*. 1998; 63(4):176.
- Cassidy KW, Werner RS, Rourke M, Zubernis LS, Balarman G. The relationship between psychosocial understanding and positive social behaviors. *Social Development*. 2003; 12:198–221.
- Crais E, Douglas D, Campbell CC. The intersection of the development of gestures and intentionality. *Journal of Speech, Language, and Hearing Research*. 2004; 47:678–694.
- Cunningham J, Odom R. Differential salience of facial features in children's perception of affective expression. *Child Development*. 1986; 57:136–142.
- Dunn J, Hughes C. 'I got some swords and you're dead!': Violent fantasy, antisocial behavior, friendship, and moral sensibility in young children. *Child Development*. 2001; 72:491–505. [PubMed: 11333080]
- Feldman R, Greenbaum C. Affect regulation and synchrony in mother-infant play as precursors to the development of symbolic competence. *Journal of Infant Mental Health*. 1998; 18:4–23.
- Goldin-Meadow, S. Symbolic communication without a language model: The starting point for language-learning. In: Namy, L., editor. *Symbol use and symbolic representation: Developmental and comparative perspectives*. Lawrence Erlbaum; Mahwah, NY: 2005a. p. 101-121.
- Goldin-Meadow S. The two faces of gesture: Language and thought. *Gesture*. 2005b; 5:241–257. Special issue: Gestural communication in nonhuman and human primates.

- Goldin-Meadow S. Pointing sets the stage for learning language - and creating language. *Child Development*. 2007; 78:741–745. [PubMed: 17517001]
- Goldin-Meadow S, Goodrich W, Sauer E, Iverson J. Young children use their hands to tell their mothers what to say. *Developmental Science*. 2007; 10:778–785. [PubMed: 17973795]
- Harris K. Developing self-regulated learners: The role of private speech and self-instructions. *Educational Psychologist*. 1990; 25:35–49.
- Horowitz L, Jansson L, Ljungberg T, Hedenbro M. Behavioural patterns of conflict resolution strategies in preschool boys with language impairment in comparison with boys with typical language development. *International Journal of Language and Communication Disorders*. 2005; 40:431–454. [PubMed: 16195199]
- Huttenlocher J, Haight W, Bryk A, Seltzer M, Lyons T. Early vocabulary growth: Relation to language input and gender. *Developmental Psychology*. 1991; 27:236–248.
- Ipsa J, Fine M, Halgunseth L, Harper S, Robinson J, Boyce L, et al. Maternal intrusiveness, maternal warmth, and mother-toddler relationship outcomes: Variations across low-income ethnic and acculturation groups. *Child Development*. 2004; 75:1613–1631. [PubMed: 15566369]
- Iverson J, Goldin-Meadow S. Gesture paves the way for language development. *Psychological Science*. 2005; 16:367–371. [PubMed: 15869695]
- Laasko M-L, Poikkeus A, Eklund K. Social interactional behaviors and symbolic play competence as predictors of language development and their associations with maternal attention-directing strategies. *Infant Behavior and Development*. 1999; 22:541–556.
- Lagattuta KH, Wellman HM. Thinking about the past: Early knowledge about links between prior experience, thinking, and emotion. *Child Development*. 2001; 72:82–102. [PubMed: 11280491]
- Leung EHL, Rheingold HL. Development of pointing as a social gesture. *Developmental Psychology*. 1981; 17:215–220.
- Liszkowski U, Carpenter M, Tomasello M. Pointing out new news, old news, and absent referents at 12 months of age. *Developmental Science*. 2007; 10:F1–F7. [PubMed: 17286836]
- Love JM, Kisker EE, Ross C, Constantine J, Boller K, Chazan-Cohen R, et al. The effectiveness of Early Head Start for 3-year-old children and their parents: Lessons for policy and programs. *Developmental Psychology*. 2005; 41:883–901.
- MacWhinney, B. *The CHILDES project: Tools for analyzing talk, Vol 1: Transcription format and programs*. 3rd ed.. Lawrence Erlbaum Associates Publishers; Mahwah, NJ, US: 2000.
- McEachern D, Haynes WO. Gesture-speech combinations as a transition to multiword utterances. *American Journal of Speech-Language Pathology*. 2004; 13:227–235. [PubMed: 15339232]
- Mitchell S, Brian J, Zwaigenbaum L. Early Language and Communication Development of Infants Later Diagnosed with Autism Spectrum Disorder. *Journal of Developmental and Behavioral Pediatrics*. 2006; 27(Suppl2):S69–S78. [PubMed: 16685188]
- Morales M, Mundy P, Crowson MM. Individual differences in infant attention skills, joint attention, and emotion regulation behaviour. *International Journal of Behavioral Development*. 2005; 29:259–263.
- Mundy, P.; Acra, C. Joint attention, social engagement, and the development of social competence. In: Marshall, P.; Fox, N., editors. *The development of social engagement: Neurobiological perspectives*. Oxford University Press; New York: 2006. p. 81-117.
- Nelson E, Ayoub C. Patterns of change over time: Emotion expressed in the pretend play of maltreated and non-maltreated toddlers and preschoolers. *Child Abuse and Neglect*. in press.
- Pan BA, Rowe ML, Singer JD, Snow CE. Maternal correlates of toddler vocabulary production in low-income families. *Child Development*. 2005; 76:763–782. [PubMed: 16026495]
- Reich, PA. *Language Development*. Prentice-Hall; Englewood Cliffs, NJ: 1986.
- Rodrigo MJ, González A, Ato M. Co-development of child-mother gestures over the second and the third years. *Infant and Child Development*. 2006; 15:1–17.
- Rowe M, Ozcaliskan S, Goldin-Meadow S. Learning words by hand: Gesture's role in predicting vocabulary development. *First Language*. 2008; 28:182–199. [PubMed: 19763249]
- Singer, JD.; Willett, JB. *Applied longitudinal data analysis: Modeling change and event occurrence*. Oxford University Press; New York: 2003.

- Striano T, Rochat P. Developmental link between dyadic and triadic social competence in infancy. *British Journal of Developmental Psychology*. 1999; 17:551–562.
- Tamis-LeMonda CS, Bornstein MH. Specificity in mother^toddler language^play relations across the second year. *Developmental Psychology*. 1994; 30:283–292.
- Tomasello M, Carpenter M, Liszkowski U. A New Look at Infant Pointing. *Child Development*. 2007; 78:705–722. [PubMed: 17516997]
- Tomasello M, Farrar MJ. Joint attention and early language. *Child Development*. 1986; 57:1454–1463. [PubMed: 3802971]
- Trevarthan, C. Communication and cooperation in early infancy: A description of primary intersubjectivity. In: Bullowa, MM., editor. *Before speech: The beginning of interpersonal communication*. Cambridge University Press; New York: 1979.
- Vandell DL. A microanalysis of toddlers' social interaction with mothers and fathers. *Journal of Genetic Psychology*. 1979; 134:299–312.
- Vaughn BE, Kopp CB, Krakow JB. The emergence and consolidation of self-control from eighteen to thirty months of age: Normative trends and individual differences. *Child Development*. 1984; 55:990–1004. [PubMed: 6734332]
- Vygotsky, LS. *Thought and Language*. Kozulin, A., translator. MIT Press; Cambridge, MA: 1934/1986.
- Werner, H.; Kaplan, B. *Symbol Formation*. Wiley; Oxford, England: 1963.
- Yirmiya N, Gamliel I, Pilowsky T. The development of siblings of children with autism at 4 and 14 months: Social engagement, communication, and cognition. *Journal of Child Psychology and Psychiatry*. 2006; 47:511–523. [PubMed: 16671934]
- Zeidner M, Matthews G, Roberts R, MacCann C. Development of emotional intelligence: Towards a multi-level model. *Human Development*. 2003; 46:69–96.

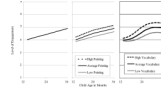


Figure 1. Effects of pointing and language on the development of children's engagement skills
Panel A. Unconditional linear growth of child's level of engagement from 14 to 36 months of age.
Panel B. Effect of child's pointing on level of engagement, controlling mother's pointing.
Panel C. Effect of child's vocabulary on level of engagement, controlling child's talkativeness, and mother's talkativeness and vocabulary.

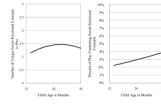


Figure 2. Average development of social-emotional concepts in play for children from 14 to 36 months of age

Panel A. Average trajectory of the number of social-emotional concepts during a 10-minute play episode for children from 14 to 36 months.

Panel B. Average trajectory of the elaboration of social-emotional concepts during a 10-minute play episode for children from 14 to 36 months.

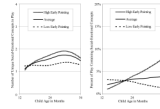


Figure 3. Effects of early pointing on the development of social-emotional concepts in children's play

Panel A. Effect of early pointing on the development of the number of unique social-emotional concepts in children's play, controlling children's and mothers' time-varying pointing and vocabulary.

Panel B. Effect of early pointing on the development of the percent of children's play that contains social-emotional concepts, controlling children's and mothers' time-varying pointing, talkativeness, and vocabulary.

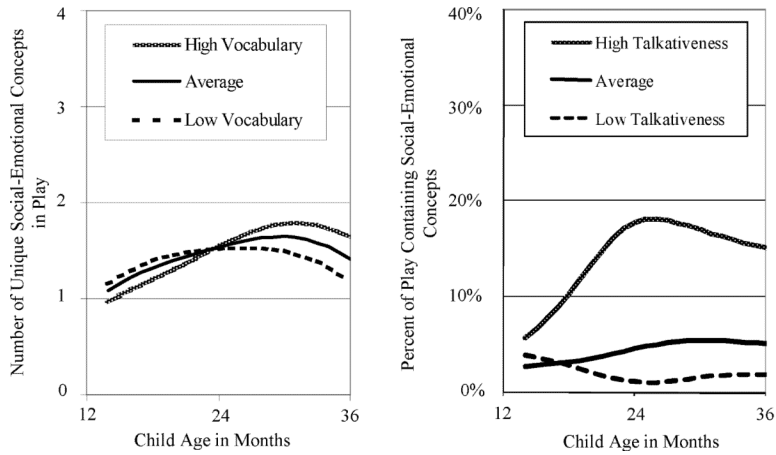


Figure 4. Effects of language skills on the development of social-emotional concepts in children's play

Panel A. Effect of children's timevarying vocabulary on the number of social-emotional concepts in their play, controlling for children's pointing and mothers' pointing and vocabulary.

Panel B. Effect of children's timevarying talkativeness on the elaboration of social-emotional concepts in play, controlling for children's pointing and vocabulary, and mothers' pointing, talkativeness, and vocabulary.

Table 1

Mean and standard deviation for predictor, control, and outcome variables at each wave.

Variables	Wave 1	Wave 2	Wave 3
<i>Predictors</i>			
<i>Child Age (AGE)</i>	14.57 (1.22)	24.57 (1.23)	37.03 (1.77)
<i>Pointing (POINT)</i>	2.58 (3.61)	5.62 (8.10)	5.07 (7.69)
<i>Talkativeness (TALK)</i>	4.99 (9.26)	87.81 (67.69)	190.88 (97.09)
<i>Vocabulary (VOCAB)</i>	2.67 (4.14)	37.63 (24.72)	73.17 (27.15)
<i>Controls</i>			
<i>Mothers' Pointing (MOM_POINT)</i>	11.66 (10.06)	13.00 (9.30)	11.81 (9.00)
<i>Mothers' Talkativeness (MOM_TALK)</i>	80.02 (44.11)	105.96 (47.26)	108.09 (44.15)
<i>Mothers' Vocabulary (MOM_VOCAB)</i>	32.57 (14.42)	50.13 (20.58)	57.69 (22.80)
<i>Outcomes</i>			
<i>Engagement (ENGAGE)</i>	3.98 (1.20)	4.54 (1.25)	4.85 (0.97)
<i>Number of Concepts (N_CONCPETS)</i>	1.14 (0.98)	1.48 (0.99)	1.28 (1.12)
<i>Elaboration of Concepts (E_CONCEPTS)</i>	1.79 (3.67)	2.06 (5.94)	2.37 (7.10)

Table 2

Engagement - Taxonomy of fitted growth models for the effects of children's pointing, talkativeness, and vocabulary on the development of their engagement skills from 14 to 36 months of age (n = 108), controlling for mothers' pointing, talkativeness, and vocabulary.

Parameter	Model A		Model B	Model C	Model D	Model E
	Unconditional Growth Model		Pointing	Talkativeness	Talkativeness and Vocabulary	Pointing and Vocabulary sans Maternal Controls
Fixed Effects						
Initial Status at 14 Months						
INTERCEPT	γ_{00}	4.0181 ^{***} (0.1149)	3.6288 ^{***} (0.1878)	3.1877 ^{***} (0.2686)	3.2434 ^{***} (0.2766)	3.6547 ^{***} (0.1376)
Linear Rate of Change each Month (instantaneous rate of change at 14 months)						
(AGE-14)	γ_{10}	0.0403 ^{***} (0.0071)	0.0340 ^{***} (0.0070)	-0.0442 ^{***} (0.0120)	-0.0769 ^{***} (0.0193)	-0.0723 ^{***} (0.0182)
Main effect of Child's Pointing						
POINT	γ_{30}		0.03614 ^{**} (0.00301)			0.01086 [*] (0.00219)
Main effect of Child's Talkativeness						
TALK	γ_{40}			0.02298 ^{***} (0.00038)	0.00410 (0.00309)	
Main effect of Child's Vocabulary						
VOCAB	γ_{50}				0.01353 (0.00891)	0.04174 ^{***} (0.00163)
Change in effect of Child's Vocabulary over Time						
VOCAB [*] (AGE-14)	γ_{60}				0.00002 ⁻ (0.00001)	0.00003 [*] (0.00001)
Main effect of Mother's Pointing						
MOM_POINT	γ_{70}		0.00249 (0.00306)			
Main effect of Mother's Talkativeness						
MOM_TALK	γ_{80}			0.00387 [*] (0.00077)	0.00418 (0.00361)	
Main effect of Mother's Vocabulary						
MOM_VOCAB	γ_{90}				-0.00003 (0.00949)	
Variance Components						
L 1: Within-person over Time	σ^2_{ϵ}	0.8306 ^{***}	0.9235 ^{***}	0.7012 ^{***}	0.6881 ^{***}	0.7401 ^{***}
L 2: Between Person In Intercept	σ^2_0	0.7099 ^{***}	0.5072 [*]	0.6366 ^{***}	0.6610 ^{***}	0.6299 ^{***}
Between Person In Linear Rate of change	σ^2_1	0.0010	0.0003	0.0009	0.0010 [~]	0.0007

Parameter	Model A	Model B	Model C	Model D	Model E
	Unconditional Growth Model	Pointing	Talkativeness	Talkativeness and Vocabulary	Pointing and Vocabulary sans Maternal Controls
Covariance 01 Intercept and Linear Rate of Change	σ_{01}	-0.0143	-0.0230	-0.0252 [~]	-0.0235 [*]
Goodness-of-fit					
Deviance	822.8	787.6	740.0	735.0	739.0
AIC	834.8	803.6	756.0	757.0	757.0

[~] p < .10

^{*} p < .05

^{**} p < .01

^{***} p < .001

Table 3

Number of Concepts - Taxonomy of fitted growth models for the effects of children's pointing and vocabulary on the development of the number of social-emotional concepts displayed during play from 14 to 36 months of age (n = 108), controlling for children's talkativeness, and mothers' pointing, vocabulary, and talkativeness.

Fixed Effects	Parameter	Model A		Model B		Model C		Model D	
		Unconditional Growth Model		Pointing		Talkativeness and Vocabulary		Pointing and Vocabulary	
Initial Status at 14 Months									
INTERCEPT	γ_{00}	1.1496 ^{***} (0.11132)	1.2435 ^{***} (0.1998)	1.2513 ^{***} (0.3045f)	1.3092 ^{***} (0.2968)				
EARLY_POINT	γ_{01}		-0.01968 (0.01442)		-0.00456 (0.01496)				
Linear Rate of Change each Month (instantaneous rate of change at 14 months)									
(AGE-14)	γ_{10}	0.0475* (0.0220)	-0.0127 (0.0315)	0.0528 (0.0344)	0.0157 (0.0387)				
EARLY_POINT*	γ_{11}		0.00241* (0.00038)		0.00155* (0.00037)				
(AGE_14)									
Quadratic Rate of Change each Month (acceleration of change)									
(AGE-14) ²	γ_{20}	-0.0018 [~] (0.00009)	0.0001 (0.0012)	-0.0050 ^{**} (0.0018)	-0.0035 [~] (0.0019)				
EARLY_POINT*	γ_{21}		-0.00003* (0.00000)		-0.00002 [~] (0.00000)				
(AGE-14) ²									
Main effect of Child's Pointing									
POINT	γ_{30}		0.01935* (0.00444)		0.01071 (0.00448)				
Main effect of Child's Talkativeness									
TALK	γ_{40}			0.00200 (0.00378)					
Main effect of Child's Vocabulary									
VOCAB	γ_{50}			-0.02100 (0.01117)	-0.01107 (0.00475)				
Change in Effect of Child Vocabulary Each Month									
VOCAB*(AGE-14)	γ_{60}			0.00013* (0.00002)	0.00012 ^{**} (0.00002)				
Main effect of Mom's Pointing									
MOM_POINT	γ_{70}		-0.00137 (0.00241)		-0.00194 (0.00278)				
Main effect of Mom's Talkativeness									
MOM_TALK	γ_{80}			0.00053 (0.00429)					

Parameter	Model A		Model B		Model C		Model D	
	Unconditional Growth Model		Pointing		Talkativeness and Vocabulary		Pointing and Vocabulary	
Main effect of Mom's Vocabulary								
MOM_VOCAB	γ_{90}				-0.00154 (0.01132)			0.00003 (0.00241)
Variance Components								
L 1: Within- person over Time	σ^2_{ϵ}	0.6611***	0.6097***	0.6128***	0.5681***			
L 2: Between Person In Intercept	σ^2_0	0.3009*	0.3633**	0.3587*	0.4248**			
Between Person In Linear Rate of change	σ^2_1	0.0002	0.0000	0.0003	0.0002			
Covariance 01 Intercept and Linear Rate of Change	σ^{01}	0.0027	-0.0047	-0.0019	-0.0084			
Goodness-of-fit								
Deviance		623.8	548.6	609.9	540.0			
AIC		637.8	570.6	633.9	570.0			

~ p < .10;
 * p < .05
 ** p < .01
 *** p < .001

Table 4

Elaboration of Concepts - Taxonomy of fitted multi-level models for the effects of children's pointing, vocabulary, and talkativeness on the development of children's elaboration of socialemotional themes during play from 14 to 36 months of age (n =108), controlling for mothers' pointing and language.

		Model A	Model B	Model C
	Parameter	Baseline Model	Pointing	Pointing, Vocabulary, and Talkativeness
Fixed Effects				
Initial Status at 14 Months				
	INTERCEPT	γ_{00} 0.4727*** (0.1057)	0.4053* (0.1972)	0.1573 (0.2994)
	EARLY_POINT		-0.01042 (0.01179)	-0.01061 (0.01214)
Linear Rate of Change each Month				
	(AGE-14)	γ_{10} 0.0068 (0.0064)	-0.0115 (0.0097)	-0.0253~ (0.0152)
	EARLY_POINT* (AGE-14)	γ_{11}	0.00022* (0.00004)	0.00021* (0.00004)
Main effect of Child's Pointing				
	POINT	γ_{30}	0.00667 (0.00503)	0.00250 (0.00560)
Main effect of Child's Talkativeness				
	TALK	γ_{40}		0.02028* (0.00366)
Main effect of Child's Vocabulary				
	VOCAB	γ_{50}		-0.04215~ (0.01086)
Main effect of Mom's Pointing				
	MOM_POINT	γ_{70}	0.00056 (0.00260)	0.00014 (0.00320)
Main effect of Mom's Talkativeness				
	MOM_TALK	γ_{80}		-0.00012 (0.00510)
Main effect of Mom's Vocabulary				
	MOM_VOCAB	γ_{90}		0.00828 (0.01332)
Variance Components				
	L 1: Within- person over Time	σ^2_{ϵ} 0.7198***	0.6908***	0.6627***
	L 2: Between Person In Intercept	σ^2_0 0.2440**	0.2173**	0.2207**
Goodness-of-fit				
	Deviance	597.8	545.1	538.8
	AIC	605.8	561.1	562.8